11

PUBLIC WORKS

CITY COUNTY STATE

SEPTEMBER 10, 1921

PUBLIC WORKS.

CITY **COUNTY** **STATE**

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Published Weekly by Public Works Journal Corporation

Publication Office, Floral Park, N. Y. Advertising and Editorial Offices at 243 W. 39th St., New York, N. Y.
Entered as Second-Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879.

Vol. 51 **SEPTEMBER 10, 1921** **No. 11**

Crib and Cofferdam Work*

General Conditions, requirements and types. Bag, earth and sheet pile cofferdams. Cofferdams for battleship Maine, for 46th street pier, and Thames bridge.

Cofferdams are engineering structures, generally temporary, that are built to exclude river, lake, or sea water or ground water from an enclosed space and facilitate operations after construction therein. They are usually supplementary to the building of foundations such as those for bridge piers, abutments, sea walls, canal locks, buildings and other purposes, but may be used in any kind of engineering construction. They are usually designed to resist an unbalanced hydrostatic pressure and to permit the water to be pumped out on the inside.

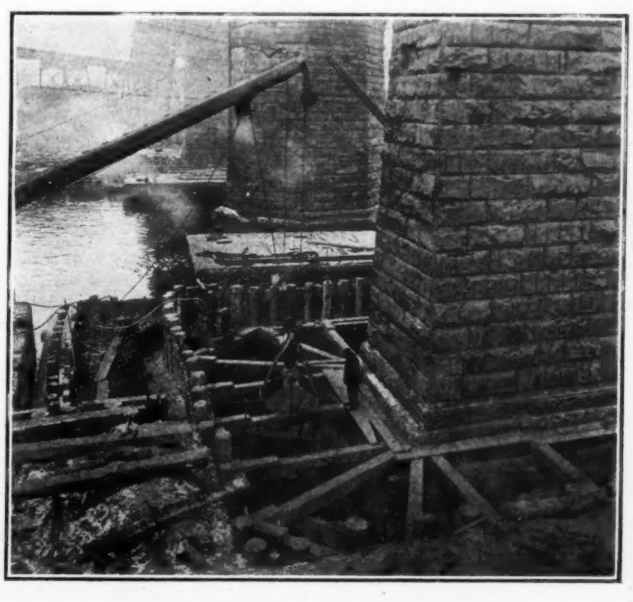
A large proportion of them are built of type and material that are considered most convenient under the circumstances, and are thus frequently without proper design so that they are often unsatisfactory and sometimes unsafe and very expensive and their construction is generally dreaded by ordinary contractors or engineers without experience in their use. This is largely due to the fact that the conditions to be met are often concealed and seldom properly investigated before the cofferdams are built unless the latter are known to be of extreme difficulty or importance.

When the water is very deep or very swift, or if the bottom is very bad, the design, construction and maintenance present many difficulties and are expensive, but even under these circumstances cofferdams can generally be successfully installed and maintained if properly designed and built but may involve large costs or other difficulties. In all cases their design and construction should be preceded by a very thorough investigation and by an exploration of the site that will dispose of all necessary information concerning the foundation.

TYPES

Cofferdams are either fixed or moveable and are built on a natural or excavated earth or rock surface or on some artificial structure.

The principal types of cofferdams are—embankments, sheet piles, sheet pile and embankments, sheet pile and fill, cellular sheet piles, framed cofferdams, detachable cofferdams, crib cofferdams and caisson cofferdams. Although cofferdams frequently consists of one, two or three sides connecting existing sides of walls they will here be considered as complete enclosures, either circular or polygonal and unless otherwise stated, as seated on or penetrating the surface of the earth or rock on land or in the river bed or at the bottom of any body of water. They will also be considered in general as having their tops a short distance above maximum water level, designed to permit the water to be entirely pumped out from their interior, leaving an unbalanced water pressure or earth pressure on the exterior.



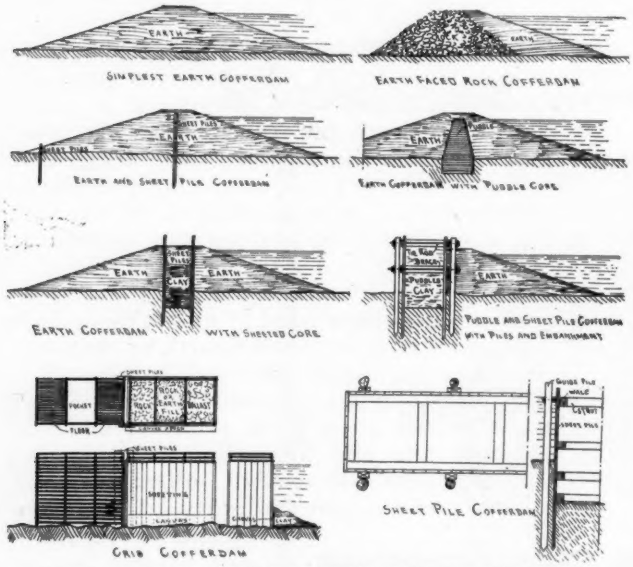
UNDERPINNING PIER OF CENTRAL VIADUCT, CLEVELAND, IN COFFERDAM WITH PUDDLE CORE BETWEEN WOODEN EXTERIOR AND STEEL INTERIOR SHEET PILES

*Abstract of stereopticon lecture delivered May 23, 1921, to the senior class in the College of Civil Engineering, Cornell University, by Frank W. Skinner, consulting engineer, associate editor PUBLIC WORKS.

Cofferdams must be designed to resist lateral displacement or overturning by the exterior horizontal pressure, to resist any erosion and impact to which they may be subjected, and to be reasonably impervious to seepage, percolation or other leaks through the body of the cofferdam, and to have a practically watertight joint between the entire base and its supporting surface, not only to prevent leak there, but to prevent upward pressure of the water, which would greatly impair the stability of the cofferdam against overturning. Usually, however, cofferdams with gravity cross-sections are built without regard to the buoyancy of the materials and have sufficient weight for statical stability.

EARTH COFFERDAMS

On smooth, hard bottom of any description low cofferdams, not more than 2 or 3 feet high, may



PRINCIPAL TYPES OF SIMPLE EARTH AND CRIB COFFERDAMS

often be quickly and conveniently constructed with bags nearly filled with earth, sand or fine concrete. These bags, when laid up with headers and stretchers in a wall as wide at the base as it is high, bond themselves together so as to fit closely and conform to the surface of the bottom. They should have few leaks and these may generally be stopped if necessary by throwing earth, sand, and clay on the outer surface.

Under suitable conditions efficient cofferdams may be cheaply and satisfactorily made with earth embankments. Ordinarily both faces of these embankments have the natural slope of the material and the thickness of the embankment at the top should be at least 5 or 6 feet and sometimes much more. The cofferdams, therefore, require a large amount of material and occupy a great deal of space, their slopes extending a long way from the center line on the inside of the cofferdam and thus necessitating very large horizontal dimensions on the center. Such cofferdams are generally built much as fills or embankments for railroad grades, the material being excavated at the site or brought in dump cars or scows and placed in position.

Sometimes all or part of the cofferdam material is derived from excavation made within the cofferdam, which builds up the embankment as it is carried down. Ordinarily this excavation would be made with a clam-shell, orange-peel or grab bucket or by a dipper dredge or sometimes even by a suction dredge, but there have been interesting examples of very cheap, rapid and efficient cofferdam construction where the cofferdam was built of material excavated from the inside of the cofferdam by a dragline bucket that excavated and deposited it in position at one operation.

Clayey sand and gravel are generally the best available materials for earth cofferdams, because they are usually abundant locally and easily form an almost impervious mass, but the cofferdam can be built of almost any convenient material from sand to gravel or broken stone to form the body if it is made with a sufficient thickness of impervious material covering the outer face or if it has a central core of such material or in fact any watertight wall or diaphragm to exclude the water provided the latter is protected and given stability by the adjacent embankment.

An earth cofferdam can be built on the most irregular surface to which it automatically adjusts itself, but its use is limited because it does not endure swift currents or wave action, tidal movements or heavy drift, and for obvious reasons it cannot often be built to great height unless the earth is provided from a nearby spoil bank or by the excavation necessarily required inside the cofferdam because otherwise the earth cannot be provided economically for so large a structure and some other type has to be designed.

If an earth cofferdam is to remain long in service it is often advisable to protect the outer slope with rip-rap or some other kind of pavement near the surface of the water. Sheet piles well driven on the center line of the cofferdam, so as to penetrate the hard stratum below the foundation and extend up into the body of the cofferdam where they are enclosed in the material for the embankment serve as core walls which are valuable elements of cofferdams on soft or quicksand bottoms and where the material of the dam itself is not sufficiently impervious. Similar results can be secured by digging or dredging a trench on the center line of the cofferdam and filling it with clay well rammed or puddled to form a wall that continues up into the embankment above. If properly made, such core walls will give very good results and resist leakage.

SIDEWALLS, SHEET PILES, CAISSONS AND LEAKS

Earth dams* with 3 on 1 slopes, built of a mixture of gravel and clay may be tight without core walls; if exposed to erosion or impact they should be protected. When built on permeable bottoms they should have some kind of integral cut-off extended down to impervious stratum if possible.

Cofferdams may be made with earth or clay

---

*Abstract of portion of lecture quoted from article on Cofferdams by the author published in PUBLIC WORKS, Oct. 23, 1920.

filled in between parallel rows of wooden or steel sheet piles driven between double rangers and connected by horizontal through screw rods. Wooden sheet piles should have the lower ends beveled and precautions should be taken to drive them with tight installation joints.

Sheet piles should be assembled all around the circumference of the cofferdam and each be driven a short distance at a time successively by a hammer going around and around the full length of the circumference of the cofferdam. Sheet piles are driven by hand as excavation progresses or by steam or air hammers with or without the aid of a water jet. They may be driven against complete interior bracing frames sunk in position beforehand. They may enclose boulders and other obstructions they cannot penetrate.

Cofferdams may have their walls made of wooden panels bearing against piles or framed skeletons, they may be complete boxes or caissons with or without batterns and with permanent or temporary, or fixed or detachable sides and may be made of wood or steel.

Leaks in cofferdam walls may be stopped by sheet piling around them, by divers' work or by filling in earth puddle, etc., outside them. When there is much upward leakage through the bottom of a cofferdam, it is often controlled by building a large cofferdam in successive sections or by subdividing it by temporary cross walls and concentrating the pumping on a much reduced area.

STEEL SHEET PILE COFFERDAMS

A large and increasing proportion of high cofferdams are made with interlocking steel sheet piles driven and often pulled with heavy hammers operated by steam or compressed air.

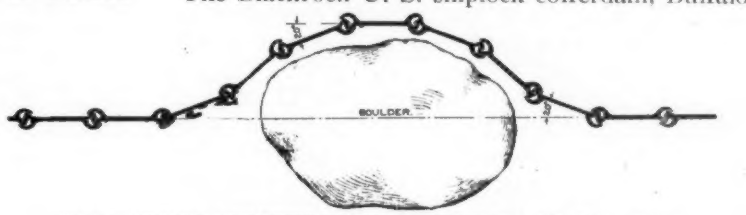
The assembling of long lengths of steel piles is often very much facilitated by attaching a guide piece to the top of the last pile assembled to promote entrance in the joint of the next pile. Steel piles can be secured in lengths as great as they can be shipped, but are ordinarily up to about 35 feet long and spliced if necessary with bolted web plate. Sometimes the lower section of the pile is allowed to remain permanently in the ground while the upper section is unbolted and removed, especially in subaqueous work.

Steel sheet piles are often pulled and redriven, some used for a sewer trench in Salt Lake City being redriven 75 times. Piles are generally assembled by means of a derrick, but for sewer trenches and the like are more conveniently handled by a traveling gantry, or similar moveable contrivance specially arranged for handling tackle with which the piles are pulled. Piles are usually pulled with tackle, with levers, and very often, especially for long piles, by means of a double-acting steam hammer. The pulling of piles is sometimes facilitated by means of a water jet or by first driving the piles lightly to break the friction. When piles are to be pulled and redriven and sometimes when they are not and the driving is very hard, they must be driven with a cap to protect the upper end. Very thin and wide piles may be protected in driving by inside and outside temporary driving bars designed in connection with the spring lock piles. Piles may be pulled with simple bolts, and with powerful grips or tongs engaging the webs with frictional bearings.

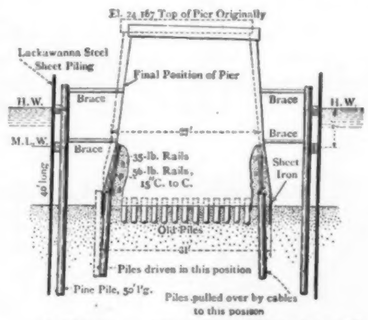
CELLULAR COFFERDAMS

Piles 72 feet long driven through clay and gravel and embanked with earth and rip-rap for the 46th St. pier, New York, were pulled by a 3,000-pound hammer combined with a tackle that exerted 40 tons tension and submerged one end of the derrick boat to a depth of 3 feet. They were pulled at an average rate of 20 in 8 hours and a maximum rate of 38.

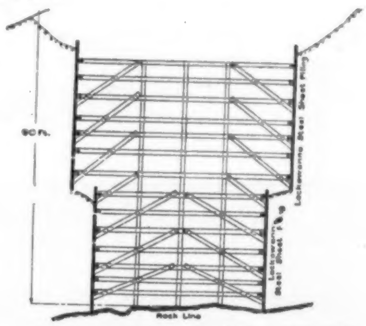
The Blackrock U. S. shiplock cofferdam, Buffalo, is 245x970 ft. with walls 30 ft. thick and 45 to 50 ft. high composed of double rows of steel sheet piles 30 ft. apart connected by interlocked steel sheet pile partitions about 30 feet apart and filled with sand, clay or gravel to give it independent stability without bracing across the interior of the cofferdam. This construction required 6,780 linear feet of steel piling weighing 6,890 tons and 60,000 yards of clay fill and clay bank. The piles were driven through about 8 feet of water and 30 to 40 feet of sand and gravel to bed rock. They were 40 to 50 feet long and were driven with a 10,000-pound steam hammer. The cofferdam was watertight and it was finally removed by pulling the piles with 6-part tackles. The filling between the partitions being first excavated to a depth of 12 feet by a clam-shell dredge.



SHEET PILES (COFFERDAM) DETOURED TO ENCLOSE OBSTRUCTION



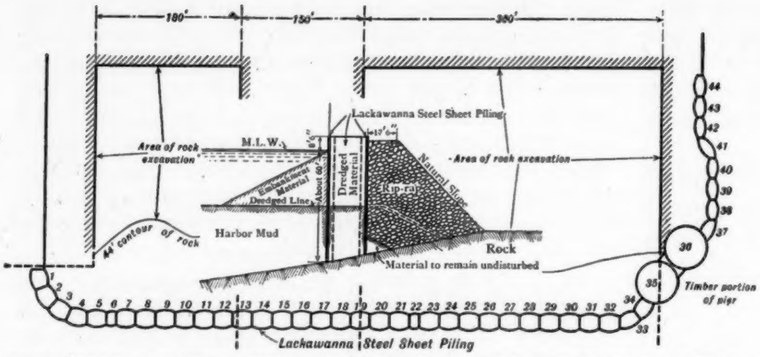
SHEET PILE COFFERDAM WITH INTERIOR PILES AND SHORT BRACES



DEEP SHEET PILE COFFERDAM WITH HEAVY CROSS BRACING

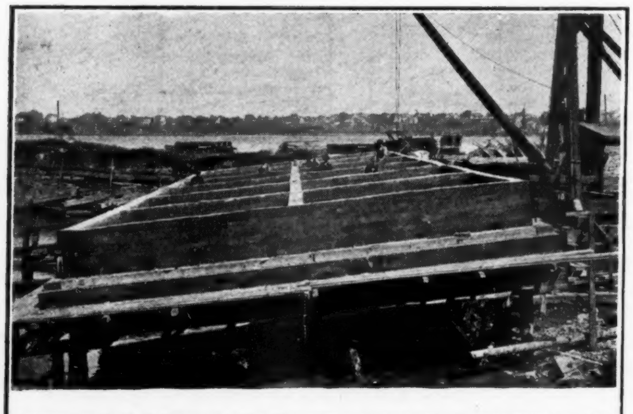
The cofferdam for the battleship Maine was about 400 feet long and 220 feet wide on center line, made with 20 tangent 50-foot cylindrical sheet pile cofferdams driven through 37 feet of water to a penetration of about 25 feet in the soft bottom, and filled with dredged material.

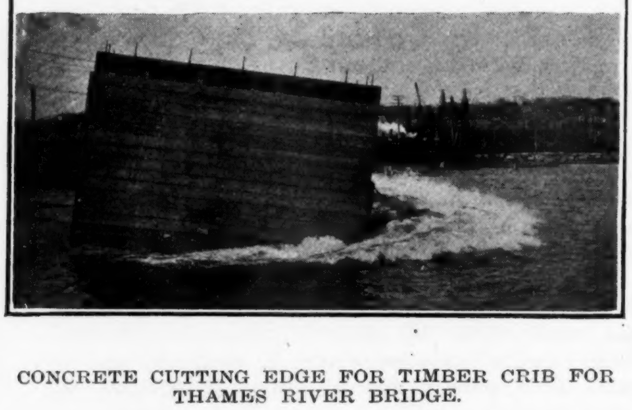
Three piers for the double-track Thames river



CELLULAR FILLED STEEL SHEET PILE COFFERDAM IN DEEP WATER WITHOUT BRACING

bridge at New London, Conn., were built with crib foundations carried to rock from 100 to 150 feet below the surface of the water 50 feet deep and through mud and sand. The 42 x 99-foot open cribs were sunk by interior dredging to depths of 90, 130 and 131 feet below low water level, each crib had vertical walls of 12 x 12-inch solid horizontal timbers covered with 12 x 3-inch sheeting and provided by interior partitions into 8 open dredging wells and 12 ballast pockets. The timber walls were seated on a reinforced concrete cutting edge 13 feet high containing 700 yards of concrete and weighing 1,500 tons. The cutting edge and about 7 feet of the lower part of the walls were built on a convenient ship railway, the bottoms of the dredging wells were temporarily closed by heavy planking and transverse trusses and the cribs were launched, completed while floating, and sunk to position by interior dredging. Sinking through the 80 feet of mud, clay and gravel was facilitated by the use of about 100 hydraulic jets under 165 pounds pressure that were finally replaced by a single 1¼-inch jet operated whenever and wherever necessary and a full pump pressure derived from a 150 h. p. boiler, sufficed to tear up the heavy clay bottom and undermine any of the pockets.





CONCRETE CUTTING EDGE FOR TIMBER CRIB FOR THAMES RIVER BRIDGE.

LAUNCHING TIMBER CRIB WITH CONCRETE CUTTING EDGE AND TEMPORARY FALSE BOTTOM.

(To Be Continued)

Powerful Floating Derrick

The new 100-ton floating derrick, designed by L. S. Rosener for the Crowley Launch and Tugboat Company, San Francisco, has a steel tripod 85 feet high mounted on a 50 x 125-foot scow, 11 feet deep, and equipped with a 100-foot steel boom. It has a capacity of 100 tons at 50-foot radius and 18 tons at maximum working radius. There are installed on the scow an oil burning Scotch marine boiler, steel tanks for 200 barrels of fuel oil, 400 barrels of fresh water, a hoisting engine, wrecking pumps, electric lighting plant and an air compressor with a capacity of 390 feet, to supply drills and other tools and to fill pontoons for floating wrecked hulls. Living accommodations for a large crew, fuel and water and other supplies are provided sufficient to enable the scow with the derrick to remain for several weeks on an outside job.

St. Lawrence River Canalization Opposed

In an address delivered to the Buffalo Chamber of Commerce, August 20, Nathan L. Miller, Governor of New York, opposed the canalization of the St. Lawrence river for ocean-going vessels at a cost estimated by some experts at $1,000,000,000 or more. He considered it impracticable and that it was promoted by agitators and impractical theorists and not by able, practical navigators.

He objected under present financial conditions to taking from the treasury of the state money to construct a waterway in a foreign country, especially when that money is needed to develop all of our own harbors from Boston to Galveston, and to improve our own waterways. Specifically he pointed out that the Mississippi can be capable of tapping a large section of the grain belt and it might then be more economical to ship some of the grain from that belt to the Gulf, and he does not propose to permit the St. Lawrence water power rights to be turned over to private interests.

Hydro-Electric Power in France

It is reported that the French Government has prepared plans and is expecting to carry out construction of hydro-electric power plants along the River Rhone, which will have a capacity of 800,000 h. p. and cost twenty-five hundred million francs, or say about $300,000,000. In addition to creating the power named, it is said that it will also make possible the reclaiming by irrigation 500,000 acres

of waste land around the mouths of the Rhone. The carrying out of the entire plan will probably take 15 or 20 years, but the first feature, consisting of a great dam at Genisseat and a smaller one at Bellegarde may be completed within 10 years, the dam to be about 200 miles from Paris and current to be brought that distance for lighting and other use in the capitol. In addition to creating power and irrigation, this development would make the Rhone navigable for a distance of about 300 miles above Marseilles.

A Small Derrick Operated by Two Hoists

A home-made derrick, operated by compressed air was recently used for clearing away the debris of a burned 600-ton mill of the Silver Queen Coalition Mines Co., at Park City, Utah, about 35 miles south of Salt Lake City.

The derrick mast and boom were made with telegraph poles and were rigged with simple tackles made with single-sheave blocks. The lead lines passed around sheaves mortised in the boom and mast, and were operated by separate Little Tugger hoists bolted to the lower part of the mast.

This derrick had a capacity of about 3 tons and handled 90 per cent of the wreckage from the fire. The boom was swung by hand.

The hoists, operated by compressed air, are very light, compact units consisting essentially of a drum, driven by a small rotary engine enclosed in an attached housing. They are very simple in construction and operation and are so light that they are portable and convenient to attach to almost any available support and can be used for a great variety of purposes in hoisting, hauling and the like, wherever there is a convenient supply of compressed air and especially where the service is light and where space is limited as in tunnels.

California Hydro-Electric Power

Since last summer, when a power shortage developed in California, 300,000 horsepower has been developed by new hydro-electric plants and plants with a capacity of 250,000 horsepower are under construction. The power companies of the state prepared plans for developing a million and a half horsepower by 1930, the power available a year ago having been about one million horsepower.

One of the recently completed plants, the Caribou plant of the Great Western Power Company, is said to have broken the world's record by transmitting current at 165,000 volts over aluminum cables nearly one inch in diameter for a distance of 186 miles to the San Francisco Bay district.

Most of the increase is hydro-electric power, but one plant uses natural gas for power and another burns coal.

Detroit Water Mains

Installation, maintenance and cost of water mains in the 1,368-mile system that in the year ending June 30, 1920, supplied a daily average of 151,997,985 gallons.*

The city of Detroit with a population of 993,739 and an area of 79.7 square miles, has a water distribution system of 1,368 miles of all kinds of pipe from 2-inch to 48 inches in diameter, supplying the high, low and intermediate pressure districts, into which the city is divided.

The total pumpage for the year was 55,631,262,500 gallons at a cost of $389,164.96, including $156,825.83 for labor and $209,672.27 for fuel. Figured on the total maintenance plus the interest on bonds, the cost of supplying water was $15.02 per million gallons. During the year 109 miles of new water mains were completed and the total cost of work on the mains completed and in progress during the year was $3,121,950.14.

AMOUNT AND COST OF NEW MAINS

The principal sizes of pipe laid included 273,684 lineal feet of pipe 6 inches in diameter, 243,050 feet of 8-inch, 24,957 feet of 12-inch, 8,312 feet of 16-inch, 9,573 feet of 24-inch, smaller quantities of 10, 30, 36, 42 and 48-inch, the total amount of pipe from 24 to 48 inches in diameter, inclusive, aggregating 7 miles. Two large additional storage yards have been acquired and the city maintains a large supply of pipe for repairs, extensions and replacements, from which there were issued in the last year 58,325 pieces of pipe in sizes from 6 inches to 48 inches, weighing 26,661 tons; 4,239 fittings, weighing 504 tons; 1,487 gate valves from 2 inches to 48 inches in diameter, and 238 tapping valves, 2 inches to 12 inches in diameter.

On March 9, 1920, a contract was entered into with Julius Porath, contractor, for furnishing and laying 20,930 lineal feet of 48-inch lock-bar steel pipe at a price of $31.94 per foot. This pipe is made from sheets one-half inch in thickness, is dipped in "hermastic" coating and will continue as far west as Dequindre street.

DEPTH OF WATER PIPE TRENCHES

During the early days of the water works it was customary to lay water pipes with a cover not exceeding 4½ feet. This ordinarily gave but little trouble from freezing for during the mildest winters the frost will not penetrate to a depth of more than 4 feet, and during the more severe winters, as the number of meters on service connections were few, water was allowed to run with but little restrictions.

On September 18, 1919, a resolution was adopted by the board directing that thereafter all pipes laid in unpaved streets should have a cover of at least 6 feet.

*Prepared from data in the sixty-eighth annual report of the Board of Water Commissioners of the City of Detroit for the year ending June 30, 1920.

PIPE LAYING EQUIPMENT

The board now has the following machinery and equipment engaged in water pipe construction: 2 Buckeye wheel type trenching machines; 4 Austin boom type trenching machines; 1 Austin boom type trenching machine (steam power); 2 6-ton Bucyrus steam cranes; 9 Austin boom backfillers; 2 Oshkosh backfillers, without booms; 1 Buckeye automatic concrete breaker; 1 Buckeye straight drop concrete breaker; 1 Rex concrete mixer; 2 Koehring concrete mixers; 1 Austin 17-foot steam concrete mixer; 1 Ingersoll-Rand portable air compressor; 1 Chicago pneumatic portable air compressor; 1 Sullivan portable air compressor; 1 No. 4 King road grader; 1 3-inch pulsometer with boiler; 1 4-inch pulsometer without boiler; 2 11 x 11 x 12-inch locomotive type air compressors mounted on Bucyrus steam crane; 1 11 x 11 x 12-inch locomotive type air compressor mounted on Austin steam trenching machine; 1 15-ton double truck Browning locomotive crane; 2 20-ton double truck Orten & Steinbrenner locomotive cranes; 4 4-h. p. gasoline Parker mud pumps; 14 3-h. p. gasoline Parker mud pumps; 1 2½-h. p. gasoline Novo high pressure test pump; 1 3-h. p. gasoline driven odorless pump.

The board now owns and operates automobiles as follows: 18 Ford roadsters and light delivery; 1 Ford coupe; 11 Ford 1-ton trucks; 2 Dodge sedans; 3 Dodge touring cars; 10 Dodge roadsters; 17 Dodge commercial cars; 1 Buick ¾-ton truck; 3 Packard 2-ton trucks; 1 Packard 3-ton truck; 1 White 3-ton truck; 2 White 6-ton trucks; 3 Packard 6-ton trucks; 1 Packard 6-ton dump truck; 1 Hall 7-ton dump truck.

The board also owns one traction motor and one 5-ton Holt tractor and five private trucks are rented as needed.

SHOP FOR CONSTRUCTION MACHINERY

Proposals have been invited for the construction of a shop for construction machinery, which will be located in the western yard. This shop will be of brick and steel construction, 90 feet wide by 120 feet long, and will contain an erection floor, blacksmith shop, machine shop, carpenter shop, sheet metal room, stock room and office.

GASOLINE

This department now uses about 140,000 gallons of gasoline for the operation of autos, pipe laying and construction machinery. On April 15, 1919, a storage tank was put in use at the storage yard, having a capacity sufficient to allow gasoline to be purchased in tank cars. This plan has proven very satisfactory, and in addition to this method proving much more convenient and the clerical work having been greatly reduced, there has been a saving of about 2.6c per gallon, or about 10 per cent of the cost of the gasoline.

MAINTENANCE DEPARTMENT

For many years all pipe laying and similar construction work has been prosecuted under the direction of a superintendent of construction, and the management and supervision of the storage yard, leak gangs and men engaged in maintenance work of the distribution system has been in charge of a superintendent of storage yard. On March 1, 1920, a resolution was adopted directing the organization of a maintenance department, in charge of a superintendent of maintenance, to include all work pertaining to the repair of leaks, the maintenance of valves, manholes, gate boxes, the lowering and moving of old pipes and pipes in service, and the laying of new pipes to replace the older and smaller ones.

REPAIRING SERVICE LEAKS

Most of the water leaks in the streets of Detroit occur in the service connections leading into private property. These connections are installed by the property owner and when leaks occur in the same they are repaired by him at his expense. Reports of leaks reach this department and are immediately investigated, and when found to be in the service connection are turned over to the property owner for repairs. Frequently considerable time elapses before repairs are made; in the meantime the excavation in the street is a menace to traffic. It is very desirable that some plan be worked out by which this board may repair such leaks in public streets as it deems advisable, and collect the cost of doing such work from the owner or occupant of the property.

FIRE CONNECTIONS

On September 30, 1920, the board directed that all fire lines installed thereafter should be metered. There are now in Detroit 126 metered and 306 unmetered fire lines.

LEAK SURVEY

In June, 1918, the Pitometer Company, of New York, was engaged to conduct a water waste survey, as follows:

1. Each section was divided into districts and the flow of water throughout twenty-four hours was gauged in each district.
2. Further investigation of all districts where excessive flow was indicated, which resulted in the location of all underground leaks on the mains or services large enough to be measured by the Pitometer Company.
3. Checking up on manufacturing concerns for the purpose of detecting any illegal use of metered water, and testing meters over four inches in place.
4. At the completion of the survey, the report of the work in detail accompanied by charts showing the variation of the flow into each district throughout the twenty-four hours and map showing boundaries of each district and location of all gauging points.

LEAKS DETECTED AND ELIMINATED

The company reported on one section February 2, 1920. This report shows an average daily consumption of 14,681,000 gallons in this section; 1,939,000 gallons per day were found wasting through underground leaks on mains and services from defective connections. These leaks were located and repaired during the time that the waste survey was being made; 2,002,000 gallons per day were found wasting through 1,995 fixtures. These fixtures were discovered by house to house inspection, made by water board inspectors

working under the supervision of the Pitometer Company. Notices were left with property owners ordering them to make repairs of any leaks discovered. Ten days to two weeks later another inspection was made and if such repairs had not been made the water supply was cut off at the curb by the boards employees. Seventy-five per cent of the fixture leaks were found on metered services. A few large meters were found stopped, and others under-registering.

In conjunction with this work it was found necessary to locate and operate practically every valve in the section, consequently the valve inspection was carried along with this work. Whenever leaky or broken valves were found they were immediately reported to the storage yard for repairs.

Since the time of the first investigation the Pitometer Company was engaged to continue the work in other sections. The report shows the average daily consumption in Section No. 4 as 10,701,000 gallons; 427,500 gallons were found wasting through underground leaks. These leaks were located and repaired; 3,000,400 gallons were wasting through 1,648 fixtures leaking. Of these fixtures 631 were faucets, 812 toilets, 87 service pipes, 9 hydrants and 109 miscellaneous fixtures. The fixture leakage in this section was approximately 42 per cent of the total subdivision night rate flow; 78 per cent of these fixture leaks were on metered services.

PIPE LINE EXTENSIONS ON PETITION

Ordinance No. 701-A allows any lot owner to petition for an extension of water main upon payment of 25 cents per foot frontage of his lot. After this petition is received, a map is prepared showing the proper size of main and amount of pipe necessary to supply this lot. All lots fronting on this extension are assessed 25 cents per foot frontage and a resolution is adopted by the board of water commissioners ordering such extensions. No property owner whose lot fronts on this extension is allowed service connection until he has paid his assessment.

CONSTRUCTION COST OF MAINS

Showing cost of mains of various sizes, material, labor, overhead expense and power machine expense.

Size	No. of Feet	Material, Etc.	Labor	Overhead Expense	Power Machine	Total
6 in.	273,684	$338,884.49	$144,611.74	$44,559.32	$33,058.94	$561,074.49
8 in.	243,050	432,168.42	188,200.25	49.574.33	29,206.10	699,149.10
10 in.	2,370	5,509.52	3,038.01	697.24	134.56	9,379.33
12 in.	24,957	75.055.57	36,344.00	8,418.45	2,151.56	121,969.58
16 in.	8,312	36,025.91	10,510.87	2.526.58	5,636.39	54,699.75
24 in.	9,573	73,921.10	21.698.00	6,089.07	8,558.26	110,266.43
30 in.	4,712	55,756.45	27,229.90	6,403.98	2,611.23	92,001.56
36 in.	2,228	45,268.26	32,881.63	12,528.34	2,912.43	93,590.66
42 in.	3,225	76,908.56	14,007.22	3.689.98	4,436.73	99.042.49
48 in.	4,401	129.620.73	22,281.02	4,679.01	7,532.98	164,113.74
Totals	756.606	1 269,232.68	500,994.76	139,204.72	96,239.18	2,005,671.34

During the year there were 75 breaks in mains, five of them being in pipes 24 inches or more in diameter.

Uniform Cost Accounting

How far may a trade association go in a uniform cost accounting system?

In putting this question to the acting chairman of the Federal Trade Commission, the Fabricated Production Department of the National Chamber of Commerce made this explanation:

"We refer to a standard plan or methods which may be developed and used by the producers of a certain line whereby they figure their costs by the same rules, including in them the same elements and differing only in results because of the variance in size of plants, equipment and local conditions—uniform as to fundamentals.

"Is there any reason why such a system may not be developed and used lawfully by an industry? Again, if conversion costs only be dealt with, is there any legal bar to the collective study of costs by the members of an industry using such a uniform cost system?"

The reply, made unofficially, is that such a collective study is not only permissible but beneficent so long as no ulterior use of it is intended. At a time when the trade associations are in considerable perplexity as to what course of conduct they may pursue, this clarification of the cost accounting problem should prove extremely helpful.—

Steel Erection Precautions

Cause and prevention of a majority of accidents occuring during the building of tall steel structures. Temporary bracing and careful supervision of construction loads of great importance.

In most cases the stability of a roof, especially one with trusses, is, as well as a building frame, very different during erection and after completion of the building. During erection the framework of the building is likely to consist only of skeleton members that are not able to develop their full strength because of the absence of supplementary portions of the structure like walls, floors, roof surface, and other elements that tend to hold the principal members firmly in position, prevent their displacement or deflection, and are able to offer large resistance to wind pressure and vibration.

It is, therefore, true that well-designed and well-built roof trusses, columns and other steel structures that are fully adequate to carry the working loads for which they are proportioned, may be entirely unable to resist comparatively small temporary stresses developed during erection.

TEMPORARY BRACING

This fact is so well recognized by careful designers that some of them insert extra members in the way of special braces to care for erection stresses that although left permanently in the structure, are no longer necessary after its completion. This, however, is unnecessary if reliance can be placed on the erector to make temporary provision for the stresses and conditions possible during the construction of the building.

Steel trusses, platforms, tanks or bins supported on tall steel columns may be subject to very dangerous overloads during erection, through wind pressure, temporary loadings, hoisting stresses, imperfect connections and ordinary field accidents that might be safely sustained by the finished structure but that cannot be resisted by the incompleted structure.

Usually even very slender columns and light trusses and girders can sustain heavy loads, without impact, if they are symmetrically applied and if the columns, girders and trusses are properly adjusted and maintained in perfect alignment and position. This condition is promoted by the general custom of thoroughly guying or bracing long columns and trusses as fast as they are assembled together and by avoiding heavy loads on them unless special provision is made for their support and distribution.

The principal framework of steel structures frequently consists of transverse bents made up of a long span light truss and two vertical columns that, considered as an independent bent, has little stability. Roof trusses having comparatively small working loads to sustain are likely to be very slender and liable to buckle so that sometimes it is necessary to temporarily stiffen them by timber or other reinforcement lashed or bolted on to enable them to be safely handled in erection, although later they may be thoroughly and permanently stiffened with connecting braces and with the roof surface.

LONGITUDINAL X-BRACING

The framework of a steel building, with or without truss roof, is generally erected in transverse vertical bents and if the work is done so rapidly that proper bracing between them is omitted, a failure of any part of the building is likely to be progressive and the collapse of one bent may be transmitted throughout the entire building and cause the fall of the whole. This is very easily prevented by the simple expedient of bracing the bents together with longitudinal vertical X-bracing either permanent or temporary. The omission of such bracing, unless the permanent walls and roof are erected as rapidly as the bents themselves, is nothing short of criminal and always invites disaster, which often responds.

A large majority of the serious accidents during the erection of steel frame buildings are due to the omission or imperfection of longitudinal X-bracing that virtually should transform the separate weak independent sections to a combined whole that possesses multiplied strength equivalent to that of a great truss. The use of longitudinals alone to connect the successive bents is probably seldom or never omitted but of itself is inadequate if they serve merely to transmit the stress from one bent to another which if sufficient to cause the collapse of one bent may cause the collapse of all.

IMPROPER CONSTRUCTION LOADS

Another serious erection danger is in the careless or ignorant application of an undue load to a truss or floor, or to a load improperly applied or in the wrong position. Trusses are often so designed that, in the finished structure they can scarcely be overloaded under ordinary conditions while in the unfinished structure a very moderate load may be sufficient to destroy them.

A shed roof in California was built with wooden trusses that, during erection were overloaded with building materials not placed in the proper position, that caused its collapse. This accident was not investigated and was followed by a similar one about a week afterwards which caused the destruction of a 74-foot span truss and caused the death of one man and serious injury of another. This accident was entirely preventable and inexcusable and in commenting on it, the California Safety News published by the Industrial Accident Commission of the state of California very pertinently says:

"Both failures were due to unsymmetrical loading. The truss that failed, causing the second collapse, was 74 feet in span and had no counter or knee bracing. No allowance was made for stiffening and bracing the long trusses of this structure during construction.

The following precautions, if observed, will prevent a recurrence of such a collapse:

1. All long trusses shall be reinforced with counter and knee bracing.
2. No truss or roof member shall be loaded until the truss is completely bolted and all purlins and braces connected.
3. In the case of light trusses having no purlins, temporary struts shall be securely fastened to the top and bottom before the truss is loaded.
4. Concentrated loads placed during construction shall in no case exceed 3,000 pounds, or 1,000 feet board measure of lumber.
5. For short trusses where the derrick or loading device can distribute the load over the entire truss, the load shall not exceed the total amount of the roof sheathing supported by the member in the finished structure.
6. All sheathing shall be evenly and symmetrically distributed across the entire truss with not more than one-third of the load in the middle of the truss.
7. For long trusses where the derrick or loading device cannot reach over the entire truss, the load shall be distributed across the middle of half the truss and shall not exceed two-thirds of the total amount of the roof sheathing supported by the member in the finished structure. The loads shall at all times be symmetrically placed.
8. All loads shall be evenly spread in laying the roofing on either side of the center line and unsymmetrical loading shall be avoided.
9. If concentrated loads are required after the roofing has been spread, they shall be placed only over the posts at the ends of the trusses."

PUBLIC WORKS
Published Weekly
by
Public Works Journal Corporation
Publication Office, Floral Park, N. Y.
Advertising and Editorial Offices at 243 W. 39th St., New York, N. Y.

Subscription Rates
United States and Possessions, Mexico and Cuba..$3.00 year
All other countries ....$4.00 year
Change of Address
Subscribers are requested to notify us promptly of change of address, giving both old and new addresses.

Telephone (New York): Bryant 9591
Western office: Monadnock Block, Chicago

S. W. HUME, President J. T. MORRIS, Treasurer
A. PRESCOTT FOLWELL, Editor
FRANK W. SKINNER, Associate Editor

CONTENTS

An Economical Municipal Investment

The description on page 199 of the extensive water main system and its construction and maintenance facilities for the city of Detroit, is of especial interest as illustrating the systematic organization and abundant equipment provided for the extension, maintenance and operation at a cost of more than $3,000,000 per year of the water distribution in a large city. It has a cost of approximately $66 per million gallons of water used.

The cost is undoubtedly materially reduced, efficiency increased and much greater promptness secured by the provision of a city construction plant containing 42 major items of equipment besides 22 pumps and pulsometers and 75 automobile cars and trucks. This plant saves a large sum in the cost of trenching and backfilling, grading and transportation and, being available night and day, is much more reliable than the increased number of laborers that would be necessary to perform the same work with less equipment. The systemization of operations and the prompt discovery of breaks and leaks and their elimination also makes for ultimate economy.

Obviously the same details cannot be advantageously adopted in all other cities, but it is well worth while for every municipal water works department to make a careful survey of the conditions, analyze resources and requirements and plan for a comprehensive installation best suited to handle all major operations in a standard manner and with a maximum of improved labor saving equipment.

Remedies for Important Erection Dangers

The collapse of structural steel work during erection is one of the most common of serious construction accidents. It is always preventable and no matter how faulty the design of the finished structure the accidents are always unnecessary and generally due to gross carelessness or ignorance in field operations.

The three most common causes are the lack of sufficient bracing; inadequate or imperfect fitting and bolting; and improper loading. It would be impossible for most steel or iron structures to collapse as a whole during construction if they were properly X-braced.

The strength of a truss or important member may be greatly reduced by badly fitted and adjusted splices or by a deficiency of connection bolts.

There is great danger in imposing heavy loads before the structure is ready to receive them, even if it will eventually be amply strong to support them.

There is still more danger in locating heavy concentrated loads at improper points and especially in unsymmetrical and unbalanced loadings as by the accumulation of large quantities of building material in temporary positions.

Excessive strains may be transmitted from derricks in service and any large force that is suddenly or violently applied has a greatly increased destructive effect.

The rules given on page 202 for roof construction are good as far as they go and should always be observed besides additional ones, according to conditions.

All steel structural work and all derrick systems, bracing and guys should be carefully inspected night and morning and safety precautions rigidly maintained.

Construction Equipment of Universal Utilities

The description on page 206 of the use of gallows frames for the erection of girder spans is a specific consideration of an appliance very common in the special work of bridge erection that is thoroughly applicable to a great number of construction purpose. There is hardly an important piece of construction work but that requires lifting, shifting, or handling of heavy pieces of machinery, large stones, castings, or other weighty objects often in places or under conditions where it is difficult to provide derricks, cranes or other mechanical apparatus for that purpose.

In a large number of such cases the gallows frame or a modification thereof can be economically and conveniently used. Its advantages are great and its

disadvantages few. It is a simple device; requires no careful design or proportioning. With a few timbers, ropes and pulleys an apparatus can be made that will handle very heavy and bulky objects, raise or lower them, load or unload them, place them on rollers, or even move them several feet in longitudinal or transverse directions quickly and safely. The gallows frames can be made and erected in almost any situation by unskilled labor, using universal materials that have full salvage value after the work is completed.

Desirable Cost Accounting

The inclination of some large interests to violate Federal laws by trust and price fixing combinations and arbitrary control of commercial operations has called for and received investigations, and penalties have been in some cases imposed, the consideration of which have raised the question of how much combination and co-ordination is permissible in accounting systems.

A formal inquiry by the National Chamber of Commerce has elicited the authoritative, but unofficial opinion published on page 201 that, properly used, uniform forms of cost accounting are not only permissible, but desirable. It is, of course, in accordance with common sense, good judgment, and good business, that contractors engineers, constructors, city officials and others interested in building and engineering construction should be encouraged to strive for improved classification of costs and for the adoption, as far as possible, by different recorders, of a uniform system of accounting that will produce comparable results in different localities under different conditions and by different recorders. These should be of great value to all designers and estimators and can be exchanged and disseminated through technical societies, chambers of commerce, and other municipal or private organizations so as to benefit the public at large, constructors and to the general advantage of the art.

It would be well for the different organizations of these interests as well as for the technical societies to appoint special committees to investigate and report with recommendations of action to secure a code of standard practice in classification, and unit costs or at least of a tentive recommendation that may be gradually extended, perfected and adopted.

Such a system should of course be prepared on broad lines with carefully prepared divisions, definitions and explanations so that there should be sufficient data to indicate all special and irregular features and enable the principal results to be reduced to a common denominator.

Concreting Large Stock Bins

A compound spouting installation for constructing the Franklin bins for the Cambria Steel Co., in a long, restricted area by continuous operations, uninterrupted by any necessity for shifting plant.

The construction of the large depressed Franklin stock bins for the Cambria Steel Co., Johnstown, Pa., involved distribution over the work and the delivery to forms of approximately 8,000 yards of concrete that was handled entirely by gravity with a system of hoisting towers, suspended chutes and revolving chutes, designed, fabricated and installed by the Ransome Concrete Machinery Co.

This system eliminated practically all hand work and the use of cars, industrial tracks or moveable apparatus and permitted the concrete to be advantageously mixed at the fixed central point and automatically distributed from this point as required to any part of the work without the use of moving equipment other than the hoisting buckets and swinging chutes. The use of revolving chutes operated by gravity and easily installed derricks, developed great flexibility and wide limits for the application of the cable suspended and counterbalanced chutes. The fact that at the derrick the chute was pivoted to the mast and at both ends of an intermediate trussed section supported on a balanced cantilever, made all portions of the area commanded easily accessible, permitting the discharge to be rapidly shifted from point to point and to be moved forward in zig-zag operations, covering the entire areas as it advanced.

TOWER, DERRICK AND CABLE ARRANGEMENT

The aggregate was delivered to the foot of a steel hoisting tower A, originally 140 feet high, that had been extended by a height of 40 feet; it was mixed in a Ransome 1-yard machine, continuously hoisted to the top of the tower A, and dumped into a hopper, discharging into steel chute 350 feet long, suspended from a cable attached to the top of tower A and reaching to a point near the bottom of tower B, where the chute delivered through a receiving hopper to a second hoisting bucket of 36 cubic feet capacity, that elevated the concrete to the top of tower B 195 feet high, where it was discharged into a receiving hopper, or to an intermediate point where it was discharged into another receiving hopper about 125 feet above the ground. Both tower hoppers were, however, mounted to slide vertically so as to be quickly set at different elevations if required.

From each hopper on tower B there extended an inclined chute suspended from a cable attached to the tower a few feet above a hopper and at the tower and attached to the guyed top of a derrick mast. All the masts were located so that it was possible to swing the chutes in circular arcs commanding a wide area, even larger than was required for the work in progress.

The upper chute from tower B had a maximum length of 320 feet and the lower chute a length of 128 feet.

COUNTERBALANCED REVOLVING CHUTES

The lower ends of both chutes delivered to hoppers attached to the masts, through which the concrete was discharged into chutes that revolved

around the masts. Each of these chutes was made in three sections, the upper end of the first section being pivoted to the mast just below the hopper and the lower end pivoted to an intermediate section about 48 feet long supported on the top chord of a counterbalanced cantilever truss that was suspended from the end of the derrick boom.

The lower section 32 feet long, of the revolving chute, was pivoted to the end of the intermediate section, and was supported at the bottom on the side of the form or on a trestle or other convenient bearing near the point where the concrete was to be discharged. A similar derrick and a three-part revolving chute was installed at about the middle point of the cable suspended chute delivering concrete from tower A to tower B, so that concrete could be diverted from this chute to the revolving chute below that commanded all of the area between towers A and B, while the two revolving chutes first mentioned commanded all of the area between tower B and the farther extremity of the work.

The continuous line chutes were all made in standard sections 32 feet long and those supported by the cables were suspended from it with 4-part manila tackles 32 feet apart on centers, attached to trolley hangers clamped to the cable.

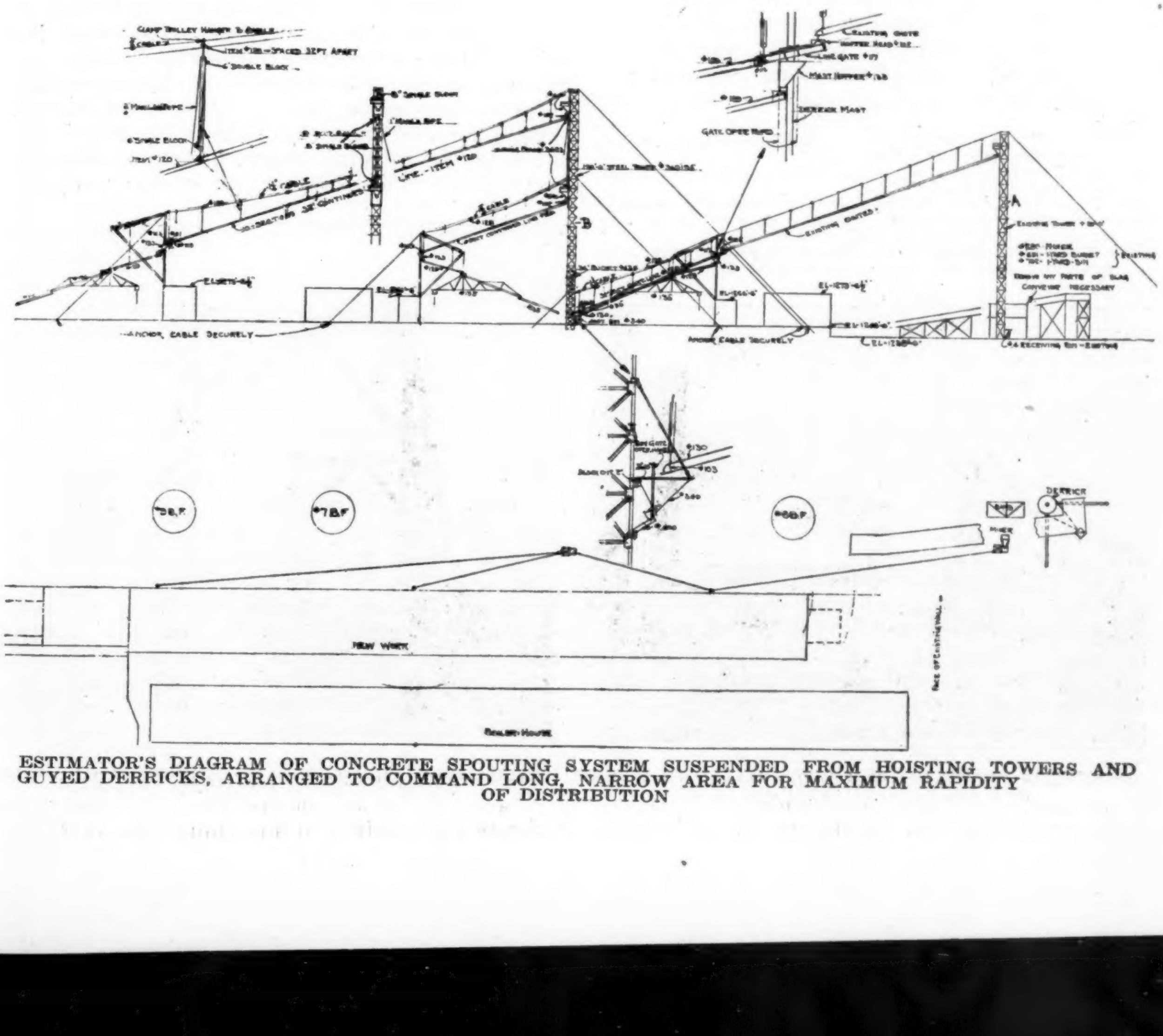
The steel tower hoppers of 40 feet capacity, were standard Ransome type, suspended by 3-part tackles, enabling them to be easily adjusted for any required height.

The entire concrete plant required for its efficient operation 12 men, including those at the mixer, and exclusive of those who spread the concrete after it was deposited in the forms. The greatest distance from the concrete mixer at which the concrete was deposited was 810 feet and it was all placed at or below ground level.

The plant had an estimated capacity of 40 yards per hour, limited only by the nominal capacity of the mixer. The slope of the chute averaged 1 in 3, being sufficient to assure a continuous flow of the concrete without obstruction, so that it was not ordinarily necessary for attendants to scrape or clean the chutes. The hoppers were provided with gate valves at which attendants were stationed to cut off the flow temporarily if needed, and to regulate it. All the concrete plant was standard Ransome equipment, easily installed and removed, portable for use for general construction operations and possessing high salvage value after completion of job.

The essential feature of this plant was the location of the three derricks so that their radius of operation covered the entire length of the work to be done without any shifting of the derricks or of the cables suspended to chutes.

The plant once set up, the concreting could take place continuously without any stop for shifting chutes or changing forms. It was estimated that 11 days of continuous pouring would complete the job. This work was in very restricted quarters between a line of blast furnaces on one side and a boiler house on the other and when work had once been commenced it had to be carried through in the shortest possible time.



ESTIMATOR'S DIAGRAM OF CONCRETE SPOUTING SYSTEM SUSPENDED FROM HOISTING TOWERS AND GUYED DERRICKS, ARRANGED TO COMMAND LONG, NARROW AREA FOR MAXIMUM RAPIDITY OF DISTRIBUTION

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Handle and Erect Girder Spans Without Special Equipment—VI*

With gallows frames.

When derricks, derrick cars or their equivalent are not available one of the most popular means of unloading, loading and erecting long and heavy girders is by means of a pair of gallows frames, from which tackles are suspended to raise and lower the girder and to shift it if necessary a few feet longitudinally or transversely.

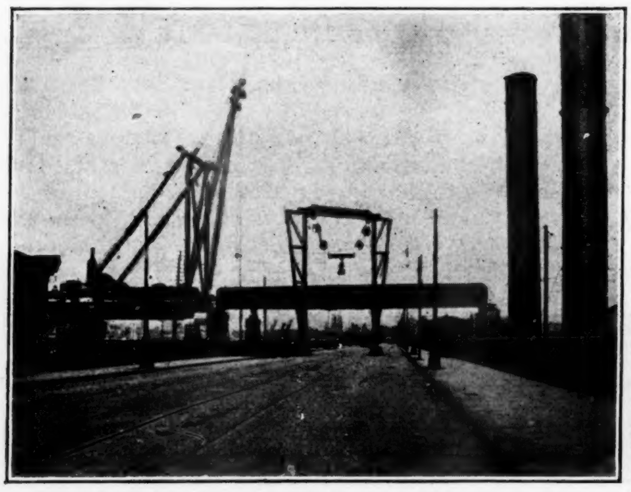
The principal advantages of the gallows frames are that they are of very simple design and easily, quickly and economically constructed from almost any available new or second hand timber; that they are very strong and can handle large weights safely; that they can be given great stability; that they can be very easily and quickly erected; readily shifted from place to place; and can easily be arranged to clear all obstructions and to avoid any interruption of traffic or impediment of train service.

*Part I.—Transportation to site and erecting by steam protrusion was published July 3.
Part II.—Erection by cribbing, jacking, rolling and skidding was published July 30.
Part III.—With fixed derricks was published August 6.
Part IV.—With locomotive cranes, derrick cars and wrecking cars was published August 13.
Part V.—With locomotive cranes, derrick cars and wrecking cars, was published August 20.

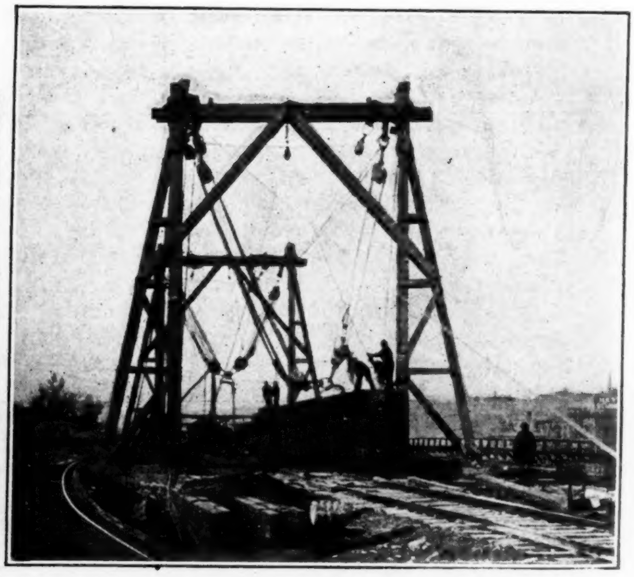
PRINCIPAL FEATURES

A gallows frame consists substantially of a horizontal cap supported at each end on the top of a vertical post. It may be made of any convenient dimensions, usually from 10 to 30 feet high with vertical posts from 5 to 30 feet apart. The vertical posts should be of the same length at both ends, cut square, and the transverse part should have full bearing on the posts and be connected to them with scabs bolted to cap and posts. They are usually made out of square timber, 6 x 6 inches and upwards, and the caps should be knee-braced to the posts. If extreme clearance through the gallows frame is required the caps may overhang the posts and have the braces on the outside of the posts, otherwise it is better to put the braces on the inside of the post, thus strengthening the cap as a beam; continuing the braces to a point at or near the center of the cap greatly increases the strength of the latter. A pair of gallows frames made of 12 x 12-inch timber throughout, with the caps knee-braced near the center if their length is great, or made with two timbers, one on top of the other, are strong enough to handle any girder that is likely to be erected.

Each gallows frame should be secured by a pair of transverse guys in opposite directions attached to each end of its cap and, of course, properly



ERECTING PLATE GIRDER WITH GALLOWS FRAME SET OBLIQUE TO BRIDGE AXIS



UNLOADING, FLEETING AND ERECTING GIRDERS WITH TRUSSED GALLOWS FRAMES

anchored at as flat an angle as possible. In some cases, particularly where a great deal of work is to be done with the gallows frame in the same position or with frequent short removals, and they are not too far apart, they may be connected by longitudinal timbers and bracing, thus forming a rectangular skeleton tower that will be stable without guys. If seated on soft ground the lower ends of the vertical posts should rest on sills.

Each gallows frame must be provided with a tackle suspended from any point of the cap between the vertical posts and operated by a hand windlass or hoisting engine.

METHOD OF USE

For unloading girders from railroad cars the gallows frame generally should have both horizontal and vertical clearance for trains on one, two or three tracks, as may be required. They are generally set up transverse to the track over which they operate, but if clearance is limited or if necessary for any other reason, they may be placed with their caps oblique to the tracks served.

The car from which the girder is loaded is run under and through the gallows frames, a tackle from each gallows frame is attached to the nearest end of the girder and operated sufficiently to lift it clear of the car, which is then removed and the girder can be lowered directly to trucks or rollers underneath, or lowered to the ground.

Usually the gallows frames are separated by a distance slightly less than the length of the girder so that both ends of the girder project slightly beyond the gallows frames, but the frames may be put each within a few feet of the center of the girder on opposite sides of it, or they may be a short distance beyond the end of the girder if circumstances require it or the girder may be swung and lowered to different positions relative to gallows frames located in the usual manner for unloading it.

The girder may be shifted longitudinally in the tackles by swinging them to inclined positions before they are connected to the girder and then slacking off on one tackle as the other tackle is operated when the girder is suspended freely in them.

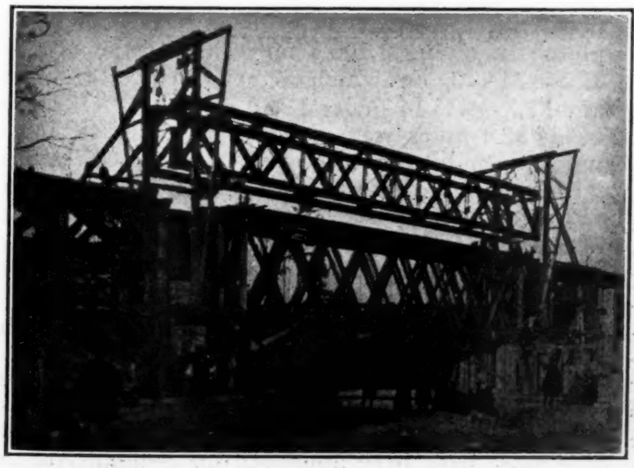
Similarly the girder may be shifted transversely by swinging it in the tackles. In order to swing it any considerable distance either longitudinally or transversely, one or two additional tackles are required and the operation is known as fleeting. A girder can easily be fleeted across the full width between the vertical post of a gallows frame by means of two pairs of tackles both suspended from the ends of the caps of the gallows frames. Both tackles of each gallows frame being attached to the girder near the ends and set up tight so as to suspend the girder, one tackle is slacked off while the other is operated and pulls the girder across the full width, or any part of it, of the horizontal opening in the gallows frame.

Complete single track railroad spans consisting of a pair of girders with their cross bracing, can readily be set on flat cars, run over the old bridge to required position, lifted from the cars and held suspended from the gallows frames while the cars are run off from the old bridge, the old spans torn down and removed, and the bridge seats adjusted to receive the new spans which are lowered to place on them without moving the gallows frame.

On the Chicago-Milwaukee & St. Paul Railroad, where it was at one time necessary to handle all girder spans of more than 75 feet with gallows frames, a pair of 40,000-pound plate girders were erected by two gallows frames in 45 minutes.

A wooden Howe truss span across Walnut creek, Ohio, was replaced by a steel span having two 91-foot plate girders, 9 feet deep, that were unloaded from cars at the site by a gallows frame with four tackles at each end which held the girders suspended while the cars were removed, the old wooden trusses stayed by lateral braces, and the old floor and cross bracing removed, permitting the new girders to be lowered to position on the substructure, a new floor built on them and traffic resumed, after which the old trusses were removed at leisure.

In the erection of a new bridge with heavy plate girder spans supported on masonry piers and abutments, the girders were delivered on a service track laid on a temporary wooden falsework tres-

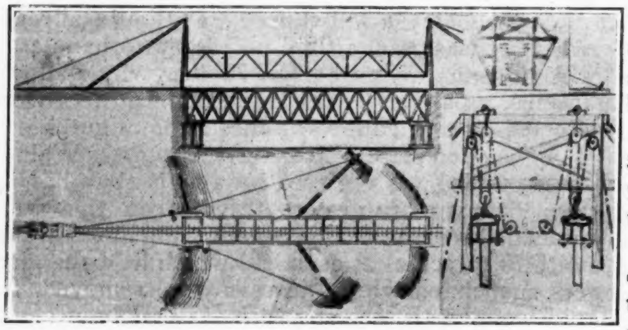


ERECTING COMPLETE LATTICE GIRDER SPAN AND REMOVING OLD SPAN WITH TWO GALLOWS FRAMES

ERECTING COMPLETE PLATE GIRDER SPAN WITH FALSE-WORK AND TWO DOUBLE-POST GALLOWS FRAMES

tle built between the piers and were unloaded by gallows frames seated on the pier tops. The gallows frames were of special construction with outside batter posts and 2-piece caps with their ends separated about 4 feet at the center of the gallows frame and connected by a top splice timber with long bolted overlaps. The end pieces of the cap served as corbels, supporting the heavy center piece of the cap that reached a little beyond the vertical post at each end, and was thoroughly bolted on the corbels. The girders were delivered in pairs, riveted together with their cross-pieces, making complete spans that were handled by two heavy tackles at each end by which they were lifted from the cars and the latter removed, after which the falsework also was removed and the girders lowered to position by the tackles.

A wooden Howe truss bridge in Canada was replaced by a pair of iron latticed girders riveted to gether and shipped and erected as a unit. The cars bringing the new span were run over the old span and the new span was unloaded by two tackles at each end suspended from the trussed caps of the gallows frames.



ERECTING 98-FOOT SPAN AND RAZING OLD SPAN WITH BRACED AND GUYED GALLOWS FRAMES, LOCOMOTIVE AND ANCHORED TACKLES

These gallows frames were trussed on the outside of the vertical post and each was equipped with the two tackles rove with the same line, each end of which was carried to a hoisting engine drum, thus securing equalized strain throughout the entire funicular system.

On account of the great weight of the span it was lifted slightly by jackscrews, the tackles set up tight and the screws removed, leaving the spans suspended from the gallows frames and permitting the withdrawal of the cars. The transverse bracing in the old bridge was cut away and the tackles, anchored at the lower ends, were attached to the middle of the top chords of the old trusses and their lines being lead through snatch blocks were connected to a bridle made fast to a locomotive engine that, pulling on them, overturned the old trusses and dragged them along the bed of the stream, where they were dismembered at leisure. The new trusses were then lowered to their permanent position in the substructure and traffic on the new span was resumed after an interruption of only 6½ hours, of which 2 hours were required to swing the new span with the gallows frame, one hour to prepare the old bridge, 15 minutes to demolish it and 45 minutes for lowering and setting the new spans.

The job required 224 single days' work performed by a gang of 11 men in twenty-two days when the mercury was 40 degrees below zero. The total cost of the work, including $14 for fuel, $40 for locomotive rental, and $148 for superintendent's salary, was only $898, equivalent to $22 per ton.

To Be Continued

Sand-Clay Roads in North Carolina

The progressive policy of road building and maintenance in North Carolina is emphasized by the recent $50,000,000 bond issue and by $10,000,000 worth of work projected for the current year, much of which will be sand-clay road construction and fall grading on lines that will be paved with concrete next year.

The amount and rapidity of the work is greatly increased by the approach toward pre-war conditions, which have reduced prices so that while $.60 per yard is being paid for some road grading now nearing completion only $.30 is paid on new contracts, some of which, however, will probably show a loss that has been accepted in some instances in order to provide work for large numbers of idle teams.

In this state the sand-clay roads costing about $4,500 per mile, are surfaced with naturally mixed material, which, in many cases, is found so close to the road that it may be handled with wheeled scrapers. One of these can deliver about 100 cubic yards per day when the haul is not more than 300 feet. Above 1,000 feet 3 cents a yard is allowed for overhaul. The sand-clay is spread on the road surface with a blade grader and crowned about 12 inches. J. T. Plott, Greensboro, has contracts in several counties aggregating 117 miles on which he employs a total force of more than 300 mules.

$7,366,314.20 Spent for Texas Highways

According to the Texas State Highway Department, 130 new road projects have been completed involving 1,106.1 miles at a total cost of $7,366,314.20, on which $1,312,258.85 State Aid and $1,794,335.14 Federal Aid was paid. Of these roads 32.4 miles were paved with concrete, 142.5 miles with bituminous materials and 607 miles with gravel. There are now under construction 192 projects involving 2,300.8 miles at a total cost of $26,955,348.03, and upon which sums of $9,260,986.09 as Federal Aid and $2,296,217.61 as state aid have been granted.

Of these projects, 83.7 miles are paved with concrete and 421 miles with bituminous materials. Seventeen other projects totaling 144.2 miles are not yet under contract. Ten additional contemplated projects are not yet approved, while sixty-five more have been approved for Federal Aid to the extent of $2,697,078.84 and State Aid to the amount of $1,208,740.52.

Recent Legal Decisions

STREET RAILWAY COMPANY MAY BE COMPELLED TO PERFORM CONTRACT TO BRING THE TRACKS UP TO CHANGED GRADE AND PAY EXPENSE OF PAVING

In a suit to compel a street railway to bring its tracks to grade and complete the pavement required by a change of grade at street intersection on changing from an earth road to a paved street and for the expense caused by its failure to do so, the Pennsylvania Supreme Court holds, Borough of Sayre v. Waverly, Sayre & Athens Traction Co., 113 Atl. 424, that equity has jurisdiction to compel a street railway company to specifically perform its contract with the municipality for the making of street improvements; and, having obtained jurisdiction for that purpose, it will, to prevent a multiplicity of suits, grant complete relief by ordering such company to pay the loss its failure of performance caused the municipality. The street railway company's financial embarrassment and difficulty in procuring material and labor were held to constitute no legal excuse for failure to perform its contract; and its alleged inability to procure new rails was entirely without merit, as the city offered to permit the company to use the rails then in place.

As the street crossings affected were all on the ground long before the pavement was started, and there was no attempt or intention of establishing, abolishing, relocating, or substantially changing the grade of any crossing; the case did not fall within the jurisdiction of the Public Service Commission. "A municipality is not required to get the consent of the commission before it can make an inconsequential change of a few inches in the grade of its existing street intersections, rendered necessary by a street improvement, although there may be a railway track upon the street so improved. This is especially so where, as here, the railway company is under contract to conform the grade of its track to that of the street as the municipality may establish it."

ZONING ORDINANCE HELD NOT AUTHORIZED AS NOT APPPLYING TO ALL WITHIN ZONE

In a suit by a village to restrain the erection of a public garage in violation of a zoning ordinance forbidding infringement "without a special permit to be granted only upon resolution of the board of trustees and after a hearing," it is held, Village of South Orange v. Heller, New Jersey Court of Chancery, 113 Atl. 697, that such an ordinance is invalid under New Jersey P. L., 1920, p. 455, the power delegated to municipalities by that statute being to fix zones within which certain supposedly obnoxious businesses are not to be carried on and buildings intended for these purposes are not to be erected, and the restrictions imposed are to be uniform and obligatory upon all persons and property alike throughout the zone. The discretionary powers reserved to the trustees by the ordinance to give to one and withhold from another the privilege of violating the ordinance is not conferred by the act.

STATUTE DECLARING MUNICIPALITY NOT LIABLE FOR FAILURE TO FURNISH WATER TO EXTINGUISH FIRE HELD VALID

The North Carolina Supreme Court holds, Mack v. Charlotte City Water Works, 107 S. E. 244, that the state statute, Section 2807, C. S., which provides in part as follows: "The city may . . . maintain its own light and water works system to furnish water for fire and other purposes, and light to the city and its citizens, but shall in no case be liable for damages for a failure to furnish a sufficient supply of either water or light," is well within the legislative powers to the extent that it applies to "official acts, governmental in character, or for the benefit of the public generally." and under this statute a municipality is not liable for failure to furnish an adequate water supply to extinguish a fire and save the plaintiff's building.

MISSISSIPPI ROAD COMMISSIONERS HELD WITHOUT AUTHORITY TO LET CONTRACTS UNTIL ENGINEER'S REPORT ADOPTED AND RATIFIED

The Mississippi Supreme Court holds, Ellis v. Tillman, 88 So. 281, that the provisions of Section 5, Chapter 176, Laws of 1914, providing for the appointment of road commissioners and requiring them to employ a competent engineer to survey and lay out such road or roads as should be selected by such commissioners to be constructed and maintained, and making it the duty of such engineer to make an estimate of the cost of constructing and maintaining such highway for each separate mile covered by such survey, and to report the survey and estimate to the commissioners before contracts are let for the construction, or the construction and maintenance of such roads, are mandatory, and until such survey and estimate have been filed and adopted by the commissioners and ratified by the board of supervisors, the commissioners are without authority to let contracts for the construction of such roads.

CITY MUST HAVE NOTICE OF SUBSEQUENT DEFECT AFTER REPAIRING DEPRESSION IN STREET

A city cannot be charged with notice of a defect in a street caused by a depression which has existed only a few hours before an accident, the excavation not having been made by the city. An excavation was made under a license issued by a city to a plumber for the purpose of making a sewer connection for a new building. The excavation had been twice fully repaired and inspected by the street commissioner on the morning of the accident. It was held, Strang v. City of Kenosha, Wisconsin Supreme Court, 182 N. W. 741, that "in order to charge the city, notice of the defect which caused the injuries must be brought home to it in some way. The city, having once repaired the street at the place in question, in order to make it liable, must have notice, actual or constructive, of a subsequent defect, and a reasonable opportunity to repair."

NEWS OF THE SOCIETIES

Sept. 7-9—LEAGUE OF VIRGINIA MUNICIPALITIES. Annual convention. Secretary, L. C. Brinston, Portsmouth, Va.

Sept. 12-17—NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES. Seventh exposition. Eighth Coast Artillery Armory, New York City.

Sept. 12-17—NATIONAL ASSOCIATION OF SANITARY ENGINEERS. Evansville, Ind.

Sept. 12-26 — AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Wilkes-barre, Pa.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 14-15—ASSOCIATED BUILDING CONTRACTORS OF ILLINOIS. Semi-annual meeting. Danville, Ill.

Sept. 19-21—ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA. Chicago, Ill. Secretary, P. J. McAndrews, C. & N. W. Ry., Sterling, Ill.

Sept. 19-23—INTERNATIONAL ASSOCIATION OF INDUSTRIAL ACCIDENT BOARDS AND COMMISSIONER. Chicago. Secretary, Ethelbert Stewart, U. S. Bureau of Labor Statistics, Washington, D. C.

September 19-24 — ASSOCIATION OF IRON AND STEEL ENGINEERS, La Salle Hotel, Chicago, Ill.

Sept. 22-24 — NATIONAL DRAINAGE CONGRESS. St. Paul, Minn.

Sept. 23—AMERICAN SOCIETY OF MECHANICAL ENGINEERS, METROPOLITAN SECTION. Engineering Societies Building, New York City.

Sept. 26-30—ILLUMINATING ENGINEERING SOCIETY. Rochester, N. Y, Illuminating Engineering Society, Chicago Section, Chicago with National.

Sept. 26-30— NATIONAL SAFETY COUNCIL. Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventth annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS, National convention. Springfield, Mass.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 12-14—LEAGUE OF KANSAS MUNICIPALITIES. Annual convention. Lawrence, Kans. Secretary, John G. Stutz, University of Kansas.

Oct. 20-21—CITY PAVING CONFERENCE. Engineers Club of Philadelphia, 1317 Spruce St., Philadelphia. H. E. Hopkins.

Oct. 20-21—OHIO STATE CONFERENCE ON CITY PLANNING. Annual conference. Columbus, Ohio. Secretary-treasurer — Charlotte Rumbold, Chamber of Commerce Building, Cleveland.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-16—CITY MANAGERS ASSOCIATION. Annual meeting. Chicago. Secretary, H. G. Otis, city mgr., Clarksburg, W. Va.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

Nov. 16-18 — NATIONAL MUNICIPAL LEAGUE. Chicago. Secretary, H. W. Dodd, 261 Broadway, New York City.

ASSOCIATED BUILDING CONTRACTORS OF ILLINOIS

It was decided at a special meeting of the executive committee of the Associated Building Contractors of Illinois, held on July 18, that the semi-annual meeting of the association be held September 14 and 15 at Danville, Ill. Plans were made for a two-day session and it is said that the program will include a number of interesting subjects, among which will be "Present Building Costs and Conditions," "Rates of Wages as Compared with Cost of Living," "What Can Be Done to Encourage and Stimulate Construction Work?" "The Relationship as Between the Contractor and the Materialman," "The Compensation Law," and others.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS

At the fifteenth annual convention of the Association of Iron and Steel Electrical Engineers which will be held in Chicago on September 19-24, papers of particular interest will be presented. Special stress and emphasis will be given to steel mill problems and steel mining practices in papers prepared by men who have devoted years to the study and operation of electrical application and steel making processes. Chairman of the following committees will also present papers on these subjects: Education, Standardization, Safety and Electrical Development in Steel Mills.

CITY PAVING CONFERENCE

A meeting for the discussion of city paving will be held in Philadelphia, October 20th and 21st, 1921, under the auspices of the Engineers' Club of Philadelphia, with the co-operation of the Department of Public Works, Bureaus of Highways and Surveys of Philadelphia; Civil Engineering Dept., University of Pennsylvania; Philadelphia Chamber of Commerce; City of Baltimore Paving Commission; Department of Public Works, Borough of Manhattan, City of New York.

The first session, Thursday, Oct. 20, 10 a. m., to 12, and 2 to 4 p. m., will be devoted to Administrative Problems of Finance, Regulation of the Disturbance of Pavements, Regulation of Loads; Regulation of Traffic; The Obligation of Railways, Buses, Commercial Vehicles and all other users of the street; Records, Traffic Data, Future Growth and Usage; Inspection of Repairs; Inspection of New Work; The Desirability of Guarantees.

8 p. m. to 10 p. m.—Repairs and Maintenance Problems: Agents which destroy pavements; Methods of repair and restoration; Resurfacing and reconstruction of old pavements; Maintaining boxes, manhole heads, street railway tracks, etc., in connection with the pavement.

Oct. 21st, 10 a. m. to 12 noon—New Pavements: Factors upon which the necessity for new pavement are determined; The types of city paements; Fators determining the type of pavement to be used. 2 p. m. to 4 p. m.—Foundations: Sub-base, kind, character, utilization of the existing base; Preparatory steps to laying of the new pavement, such as examination of existing surface and sub-surface structures for leaks, replacements, extensions and additions; The economical depth of new foundations; The proper construction for street railway tracks to permit of efficient paving between the rails, between the tracks and adjoining the outside rail.

Evening—Subscription Dinner and Social Meeting.

There will be two principal speakers for each session. Their papers will be prepared, printed and distributed as far in advance of the meeting as possible. Synopses of these papers will be read, occupying not more than 15 to 20 minutes each. Verbal discussion will be limited to 5 or 10 minutes per speaker; longer discussions to be written and read by extracts. The complete record of the sessions, including papers and disussions, both verbal and written, will be published in the Journal of the Engineers' Club of Philadelphia.

INDUSTRIAL RELATIONS ASSOCIATION OF AMERICA

The annual convention of the Industrial Relations Association of America will be held at the Waldorf Astoria Hotel, New York, November 1 to 4. The association is the outgrowth of the National Association of Employment Managers formed in Rochester in 1918.

The Industrial Relations Association will hold a joint session on November 4 with the Academy of Political Science in connection with its discussion of industrial relations. The association's sessions will be inaugurated by a banquet at the Waldorf on the night of November 1. E. A. Shay, 671 Broad street, Newark, N. J., is the acting executive secretary of the Industrial Relations Association.

OHIO STATE ASSOCIATION OF BUILDERS EXCHANGES

The midsummer conference of the Ohio State Association of Builders' Exchanges was held at Cedar Point, Ohio, July 22. The meeting was presided over by President James J. Dalzell, of Youngstown, and delegates were present from a number of Ohio cities and from Pittsburgh, Pa. At this meeting reports were read by officers and delegates, perhaps the most important of which was the report of the secretary on the conferences held in conjunction with other state associations relative to the subject of "Taxation." Several resolutions of interest were adopted, including one approving of the American Building Exposition in Cleveland the coming winter, one to investigate freight rates on building materials, and one investigating the workmen's compensation insurance rates for the purpose of lowering said rates.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CHIPPEWA PUMPS

The steady stream, deepwell pumps manufactured by the Chippewa Pump Co., are of a continuous flow plunger power type intended to meet every possible pumping condition for either light or heavy duty and to withstand continuous and severe usage. In this pump the even rotating motion of the power shaft is converted into a reciprocating motion, applied to the pump piston that moves alternately upward at even intervals and downward by quick return strokes, so that while one is under the load the other is rapidly returning without load, stops and starts slowly upward before the first has completed its upward movement.

The principal element of the pump includes a power shaft journaled in fixed bearings and having mounted on it pinions driving large crank gears journaled on eccentric pivotal connections. The eccentric link encircles the hub of the crank gear and holds its teeth in mesh with driving pinions.

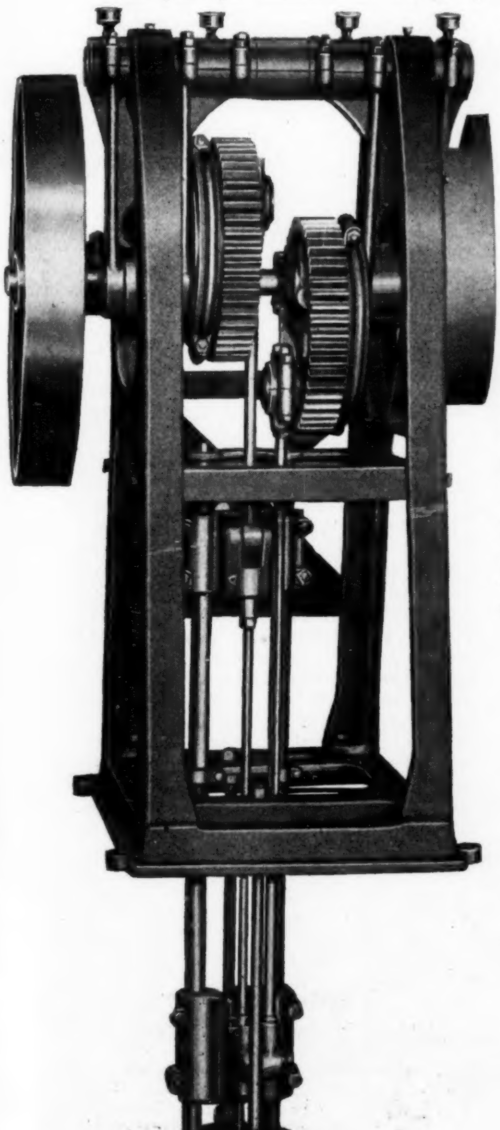
The connections of the pitman hanger to the crank gear are diametrically opposite each other so that a reciprocating motion is imparted to the plunger rods when the pitman describes an elliptical path with the long axis vertical in line with the reciprocating parts. The ellipse is irregular, one side being shorter than the other to provide a quicker downward thrust to the pump rod and the longer upstroke.

When two or more gear units are used, the strokes are made to overlap. The successive operation of the two plungers, whereby one picks up the flow before the other drops it, makes the water column move constantly and uniformly, and avoids a great loss of strain and wear of parts in overcoming interrupted motion of the water column.

All Chippewa Pumps are very simple in action and are capable of taking water from wells and delivering it directly to stand pipes or to the mains, thus eliminating water hammer and vibrations.

Different types of Chippewa Pumps are designed to meet the requirements of suburban residences, small municipalities, and for heavy duty and large capacity and deep well service required for municipalities, pumping stations, irrigation projects and for other purposes. The catalog lists pumps with capacities rated from 5.8 gallons per minute at a maximum head of 200 feet to a capacity of 135 gallons for a maximum head of 830 feet or of 800 gallons for a head of 215 feet.

The principal advantages claimed by this pump include constant moving water columns, ability to discharge directly to the mains and fire hose, non-fluctuating loads on pump mechanism and on prime mover, elimination of dead load, minimum power with maximum efficiency, low maintenance cost, accessibility, continuous even suction, silent operation, and entire absence of water hammer besides several other valuable features.



STEADY STREAM DEEP WELL PUMP

NORTHERN ROTARY PUMPS

The Northern rotary pump, manufactured by the Northern Fire Apparatus Co., will deliver from 10 per cent to 30 per cent more water per horsepower than any other pump manufactured.

It will hold a 29-inch vacuum. It will deliver 50 per cent more or 50 per cent less than its rated capacity without varying more than 5 per cent in efficiency. It has a pressure range from 50 pounds to 500 pounds.

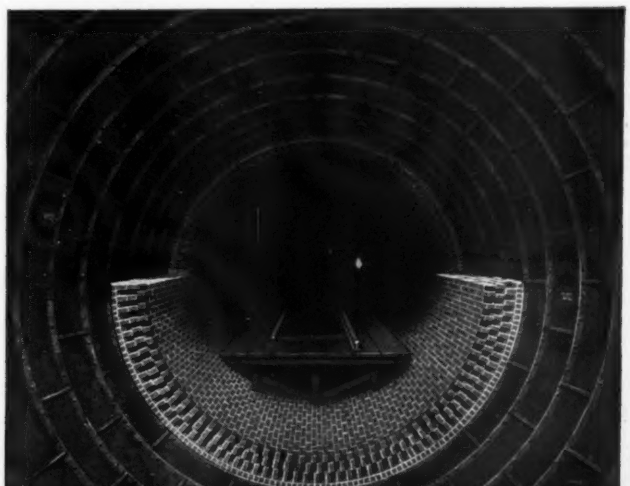
It can be equipped with a positive acting Sure Relief valve, which will automatically by-pass the water at any desired pressure.

It is small, compact, rugged and practically non-wearoutable.

TRUSCON TUNNEL LINER PLATES

The steel tunnel liner plates manufactured by the Truscon Steel Co., are flanged sections of light pressed steel plates that, bolted together, make a continuous rigid shell carried forward in the excavation to support the roof and sides a considerable distance in advance of the masonry.

They promote safety, convenience and economy and expedite the work which can be carried on either with bricks or concrete. The same company manufactures a large variety of steel forms, including those that can be used in connection with the liner plates for the inner surface of the tunnel.



TUNNEL EXCAVATION LINED WITH STEEL PLATES AND BRICK INVERT LAID ON THEM

AUSTIN CUBE MIXER

The Austin Machinery Corp., Chicago, Ill., is distributing an attractive model intended to demonstrate graphically the mixing action taking place in the Austin Cube Mixer, when in operation.

A hollow glass cube, 2 inches square, has a corked opening on one corner and a concave depression in the exterior surface at the opposite corner. It contains a small amount of red sand and a black bean, and is accompanied by a little bag of white sand.

When the contents of the bag are emptied into the cube and the latter is recorked and revolved between thumb and forefinger applied to the cork and the opposite concavity, the observer can easily watch the mixing action and see the rapid combination of the red and white sand. He can also note the kneading action indicated by the fact that the black bean is alternately covered and exposed, coming to the surface three times in every complete revolution of the cube, which turns it over six times and changes the shape of the mass twelve times for every revolution.

The operation illustrates the same conditions in the full size machine where the mixing action is continuous and the full batch is thrown toward the discharge side three times with every one of the 54 to 144 revolutions made per minute.

FOX ROTARY SNOW BROOM

The Fox Rotary Snow Broom is an attachment that can, in a short time, be attached to the F. W. D. trucks that, on other occasions are used in many states for dumping and other purposes and thus can be available for snow removal without requiring the entire apparatus to be constantly held in storage for emergency.

The broom embodies the design and improvements developed by years of experimenting and snow removing by practical men, combined with engineering advice that has produced a broom giving results claimed to be even in excess of the anticipations of the designer when demonstrated in the heavy snowstorms of February, 1921.

It is of sturdy rigid construction, easily attached to the truck chassis, and is equipped with a 50-h.p. Wisconsin motor with speed silent chain drives to the double broom.

The broom is counter balanced so as to automatically rise when it encounters obstructions, and is provided with a sheet steel shield to prevent the snow from being thrown on the sidewalks. The broom, 34 inches in diameter, will clear a road space 9 feet wide. It is made in halves clamped to the shaft and will give at least 48 hours' constant service.

In a letter from County Engineer Garwood Ferguson, the writer stated that he had witnessed demonstrations of the Fox Rotary Snow Broom and believes that this is the best type of broom for cleaning snow from highways that he had ever seen, and that for snowfalls from 8 to 12 inches deep there should be no difficulty in cleaning from 50 to 75 miles a day.

PERSONALS

Finch, Jeremiah C., has been made secretary of the New York State Highway Commission, Albany, N. Y.

Hutson, W. F., is now district engineer of the Texas State Highway Department at Waco.

Ross, F. E., has been appointed city engineer of Jefferson City, Mo.

Kendrick, William, has been appointed director of the new advisory board of highway research of the National Research Council.

McDonald, S. P., has been appointed to membership on the Alabama State Highway Commission.

Cate, D. R., is now assistant engineer to the city engineer of Sacramento, Cal.

Tempest, J. E., is now deputy city engineer in charge of street work of Sacramento, Cal.

Lyons, Edward L., has been appointed engineer of the division of the Bureau of Surveys of Philadelphia.

Barber, William C., has resigned as city manager of Dayton, Ohio.

Cornelius, Charles E., has taken over his father's business at 2139 Fulton avenue, Cincinnati, Ohio.

Froseth, O., is now in the office of the chief engineer of the Illinois Central Railroad, Chicago, Ill.

Green, George G., has been appointed municipal engineer of the Canal Zone.

Horridge, John, has been appointed supervising engineer in the division of street cleaning, department of public works, Philadelphia, Pa.

Fallon, Bernard J., has been appointed general manager of the Chicago elevated railway system.

Smith, Herschel C., has been appointed professor of highway engineering and highway transport at the University of Michigan.

Hinkley, W. O., is now engineer with the Stanley Consolidated Mines of Idaho Springs, Colo., engaged in underground surveying and the design of small structures.

Summa, Victor M., has opened an office in St. Louis, Mo., for the practice of general consulting engineering.

Ward, Robert L. E., has been made manager of the office of Weiland Engineering Co., in Canon City, Colo.

Trowbridge, Frederick J., has opened an office in Waterbury, Conn., and will practice civil engineering and surveying.

Morrison, Arthur H., is now with the Moulton Engineering Corporation, Boston, Mass.

Baldwin, E. W., will become an active member of the Mid-West Engineering Co., Coffeyville, Kans.

Andrews, John S., of the Ferro Concrete Co., Seattle, Wash., died July 17.

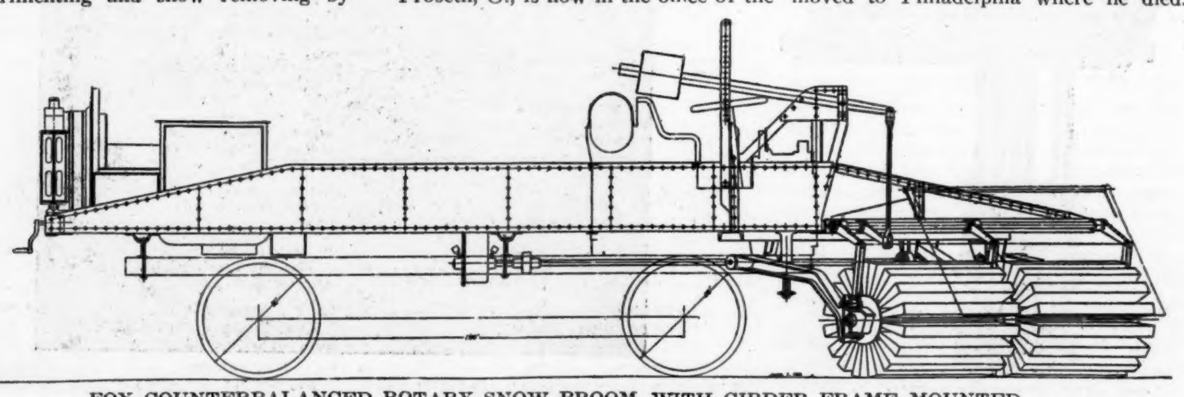
Strobridge, J. H., died July 27 in Hayward, Cal. He was constructing engineer for the Pacific and Southern Pacific Railroads.

Wilt, Josiah, died at Bethlehem, Pa., on July 24.

Gunn, William died in Winnipeg, Can., on July 24 after a long illness.

GEORGE H. TEFFT

George H. Tefft, Secretary of the Clay Products Association, Chicago, died in Philadelphia, July 7, and was buried at his old home in Springfield, Mo., July 11. Mr. Tefft, who has long been very prominent in the Clay Products interests and activities had been for some time in poor health, but nevertheless attended the annual meeting of the American Society for Testing Materials, at Asbury Park, N. J., last June, where his condition became much worse, indications of sleeping sickness were observed, and he was removed to Philadelphia where he died.



FOX COUNTERBALANCED ROTARY SNOW BROOM WITH GIRDER FRAME MOUNTED ON TRUCK CHASSIS